International Journal of Computing and Digital Systems
ISSN (2210-142X)
Int. J. Com. Dig. Sys. 8, No.6 (Nov-2019)

http://dx.doi.org/10.12785/ijcds/080614

The Effect of Awareness, Trust, and Privacy and Security on Students' Adoption of Contactless Payments: An Empirical Study

Maan Aljawder [1] and Amerah Abdulrazzaq [1]

[1] *Department of Information Systems, University of Bahrain, Manama, Kingdom of Bahrain*

Received 09 Jun. 2019, Revised 20 Aug. 2019, Accepted 20 Oct. 2019, Published 1 Nov. 2019

Abstract: The Kingdom of Bahrain has witnessed many advancements in the FinTech domain recently. One of these obvious advancements is the introduction of a few contactless payment software programs and technologies. Within the first two quarters of 2018, several institutions introduced contactless payment mobile apps such as BenefitPay, bWallet, VIVA Cash, and MaxWallet. These mobile apps received vast adoption in a relatively short period of time by the citizens in the Kingdom. This study was conducted to investigate the adoption of contactless payment technologies by the students of the University of Bahrain. The study focused on investigating the awareness, trust, and privacy and security factors related to contactless payment technologies and their impact on the willingness of students to adopt these technologies. For the operationalization of this study, a modified version of technology acceptance model (TAM) was proposed and tested through a survey.

Keywords: Contactless Payments, Technology Acceptance Model, TAM, Technology Adoption

1. INTRODUCTION

Looking at the history of payments, trading started with the barter system (i.e., commodity money), where people trade directly by exchanging goods or services. The barter system faced a lot of negative issues, which led to the invention of paper money. And because people cannot carry all their cash in their wallets, credit and debit cards emerged to solve this problem. With the further advancement in technology and rather than having to deal with outdated and slow methods of using cash and cards, people started to move toward new electronic methods that are faster, easier, less expensive, and relatively more secure. This launched a cashless and paperless approach that utilizes a sensor or camera built into almost every smartphone. This technology allows the user to walk into any store that has a scanning device, tap his or her contactless payment device on the scanner, and authenticate, thus making the payment. This type of payment is called contactless payment, and there are many emerging examples of contactless payments in the global market, such as Apple Pay, Samsung Pay, and Android Pay. In Bahrain, this idea was implemented by many establishments. The most popular applications are EasyPay, bWallet, VIVA Cash, BenefitPay, and MaxWallet. In this study, a short literature review is presented in Section 2, and the study model and hypotheses are provided in Section 3. In Section 4, the study's methodology is presented. The analytical investigation is given in Section 5, taking into account the responses of the students (the study population) who were actively involved in the survey. The conclusion and future work are covered in Section 6.

2. REVIEW OF RELATED LITERATURE

A. Contactless Payments and How They Work

The European Central Bank defined a payment as "a transfer of funds which discharges an obligation on the part of a payer vis-à-vis a payee" [1]. They also defined the payer as the participant who initiates the payment transaction or approves the transmission of funds to the payee. The payee is the receiver of the transferred money. When this transfer happens online using a smart device, it is referred to as a mobile payment [2], and when this device (payer device) communicates with the payee's device without any physical contact, it is referred to as contactless payment [3]. There are different forms of this non-physical contact. Near field communication (NFC) technology could be used to detect and authenticate the devices, or cameras could be used to scan QR codes generated for each transaction. There are many globally known applications for contactless payments, such as Apple Pay, Android Pay, Samsung Pay, Alipay, and Tenpay [2, 3], which use the NFC capabilities of smartphones to make payments. In Bahrain, there are

E-mail:maljawder@uob.edu.bh , ahaqqi@uob.edu.bh

many emerging contactless payment applications such as BENEFIT's BenefitPay, Ithmar Bank's EasyPay, Batelco's bWallet, VIVA's VIVA Cash, and CrediMax's MaxWallet. These applications require the merchant to have a contactless POS terminal [4]. The customer needs to have a device that can communicate with the POS terminal. Customers' devices vary; they can be debit or credit cards, wearable devices like smartwatches, or mobile devices such as smartphones and tablets [5]. The communication is established through an NFC controller, short message service (SMS) [30], or any other contactless means, such as scanning bar/QR codes. Merchants who accept contactless payments usually show a symbol to indicate the availability of the contactless payment option (see Figure 1.

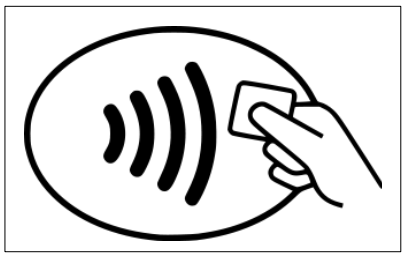

Figure 1. Contactless payment symbol.

B. Timeline of the Payment Systems

The progression in payment systems saw a huge shift in the 20th century, which began with payment cards that were commercialized in 1967 by a French international bank group called BNP PARIBAS (National Bank of Paris in English). Shortly after that, automatic teller machines (ATMs) were introduced in 1971. Next came home banking in 1983, which was introduced by the same French bank, BNP PARIBAS. This technology allowed consumers to manage their cash at home using the power of the Internet. By the end of the 20th century, the payment industry started to experience innovations in daily/micro payments by introducing mobile payments in 1999, which were commercialized by two Filipino telecommunication companies, Globe Telecom and Smart Communications. The progressions in micro payments did not stop with mobile payments. In 2000, electronic wallets came to the market, followed by chip and PIN cards in 2003, which instantly caused the amount of card payments to be greater than cash payments. The first contactless payment cards were introduced in the US in 2007 [6]. In 2014, Apple introduced its own contactless payment solution, called Apple Pay, which was a new turning point in the contactless payment industry. A year later, both Samsung and Google introduced new contactless payment technologies, called Samsung Pay and Android Pay. Recently, Apple announced the launch of its innovative Apple Card [37].

C. Implementation and Pervasiveness of Contactless Payment

Over 2.5 million merchants across 66 countries accept contactless payments, and this number is continuously growing [7]. In America, subway and bus systems are going contactless as they are considered to be fast and quick purchases for which "tap-and-go" payments are most suitable [8]. The US was late in implementing contactless payment technologies because of its complex payment infrastructure. In Asia, China is considered to be a big player in the contactless payment industry. Mobile payments in China reached over $5.5 trillion dollars in 2016, considered to be more than 50% of China's gross domestic product [9]. In Japan, contactless payments are very common; FeliCa is one of the oldest players in Japan's market. It launched its contactless cards back in 2007 [10]. Japan not only stuck to regular currency with its contactless payments but started supporting crypto currencies such as Bitcoin. Africa is also participating in bringing contactless payment technologies. First National Bank (FNB) was the first bank in Africa to support contactless payments [11]. In Eastern Europe particularly in Slovakia, most providers indicate that contactless transactions are approximately twice as fast as cash or standard payments by credit or debit card [12]. On the Australian continent, New Zealand is one of the top contributors when it comes to contactless payments. New Zealanders who carry cash are minimal; cards and contactless payments are dominant [13].

In the Gulf Cooperation Council (GCC) region, starting with Saudi Arabia, contactless payment technologies and infrastructures have been installed to cope with the rapid growth of cashless and contactless societies. Contactless payment technologies are driven by customer convenience, leading to increasing point-of-sale transactions and tap-and-go payments [14]. The UAE is moving rapidly toward contactless payment methodologies as part of its e-government strategy. Some examples of applying the digital wallet are the E-Dirham, MashreqPay and m-wallet by UAE banks in each emirate of the federation, which makes it as developed as other foreign countries. ChinaGoAbroad published that Islamic financial service providers with a collection of banks in the GCC started to adopt cashless payment solutions with electronic mobile wallets and enhanced digital services [15]. Furthermore, it announced that Kuwait Finance House (KFH) was the first bank in the GCC to launch a mobile wallet (KFH Wallet) based on the Mastercard Digital Enablement Services, which replaces card numbers with a digital token unique to a mobile device. Although it requires a PIN or fingerprint ID before completing a transaction, which might take more seconds, but it is still a great development in GCC. In Oman, "BankDhofar" introduced its mobile wallet that allows users to make transactions by registering their mobile number. "Bank Sohar," on the other hand, implemented the mobile payment clearing and switching system, allowing customers to conduct fund transfers on the official mobile banking app using their phone numbers instead of their account numbers. Obviously, Gulf countries realized the importance of contactless payment and kept improving their strategies toward the adoption of these technologies and introducing them in their banks. This demonstrates that GCC countries are considering the developments and the movement toward an easy virtual world. Ithmaar Bank contracted with Batelco and Arab Financial Services (AFS) to launch the first ever mobile payment service in Bahrain, called "EasyPay." To use the new service, customers subscribe to an Ithmaar Bank

prepaid eCard at Batelco shops or Ithmaar Bank branches and receive their NFC tags, which are then used at participating merchants. According to TradeArabia.com, Batelco and AFS have launched their service as an alternative to EasyPay, called "bWallet." The executives claimed that bWallet would enhance how people make purchases. They also added that bWallet can be obtained conveniently through either Apple's App Store or Google's Play Store. TradeArabia also mentioned that Batelco's chairman indicated that this technology builds toward the Kingdom's 2030 vision [16].

D. Users' Perceptions of Contactless Payments

Some individuals are scared of being targets of fraudulent attacks, which is why they still use cash for their payments [17]. Reference [17] also referred to a study done by Nationwide in the UK that found that 30% of citizens aged 25-34 are cautious about new emerging contactless cards. He also indicated that some experts believe that contactless cards might eventually lead in the payment industry and other obsolete technologies might be abandoned. "Contactless payments have become a significant part of the UK payments landscape, and adoption will likely increase" [18].

Another perception was reported that using contactless payment can lead to a habit of "careless" spending and reduce an individual's ability to control spending [19, 20], adding that this might lead to less control over payments if the user did not know how to use it. Based on a survey conducted by the Telegraph, 26% of mobile payment or contactless card supporters argue that the technology is safe because it requires fingerprint identification to activate it, and the credit card information is encrypted to protect card details [21]. In agreement with Green [18], Grobler, the divisional president of Mastercard Australasia, conceives that "PayPass" is a fast, convenient, and safe way to pay for purchases that are less than $100. It involves a simple tap of a card on a contactless reader, making it comfortable to use [22].

3. RESEARCH MODEL AND HYPOTHESES

The technology acceptance model (TAM) is a rigorous and influential model that is widely used to predict the user's intention to use or actually use (AU) a technology or a system through the provision of a basis to track the impact of certain external factors on internal beliefs [23, 28, 38]. The TAM framework, according to a Polish study in the banking sector, "provides an accurate depiction" of the behavioral intention to use contactless cards reality [27]. Acceptance behavior or *behavioral intention to use* (BITU) is defined as the "individual's subjective probability that he or she will perform a specified behavior."

The two primary beliefs-related factors posited by the TAM for BITU are *perceived ease of use* (PEOU) and *perceived usefulness* (PU). PEOU is "the degree to which an individual believes that using a particular system would be free of physical and mental effort," and PU is "the degree to which an individual believes that using a particular system would enhance his or her job performance" [24].

In this study, a modified version of the TAM was used. In Figure 2. the proposed model considers the main two variables: PU and PEOU. In addition, three other factors were considered: *Awareness* (A), *Trust* (T), and *Privacy and Security* (PAS). TABLE I. shows brief working definitions of the factors used in the proposed model.

TABLE I. DEFINING THE VARIABLES IN THE PROPOSED MODEL

Variable	Definition	Source
Perceived Usefulness (PU)	The degree to which an individual believes that using a particular system would enhance his or her job performance.	[24, 45]
Perceived Ease of Use (PEOU)	The degree to which an individual believes that using a particular system would be free of physical and mental effort.	[24, 38]
Awareness (A)	The extent to which the user knows about a particular technology.	[25, 28]
Trust (T)	A person's estimate of their faith in using a particular system.	[26, 28, 38]
Privacy & Security (PAS)	The degree of faith that an organization will handle all transactions securely and privately.	[26]
Behavioral Intention to use (BITU)	An individual's subjective probability that he or she will perform a specified behavior.	[33]

The external variables (factors) were adapted from previous related research. This study considers awareness, trust, and privacy and security factors.

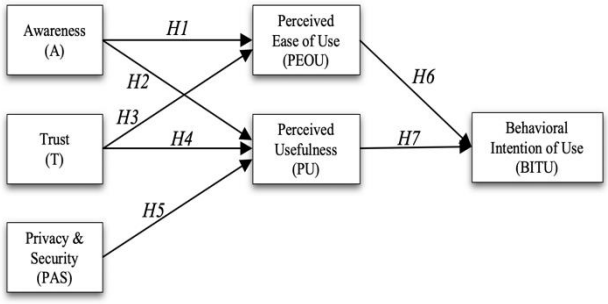

Figure 2. Proposed Technology Acceptance Model.

Awareness is one of the "early-stage" factors that influences adopting or rejecting new technologies when users become aware of the technology (the product) [41]. Earlier studies showed that, besides the value of money, consumers will go for products and vendors of which they are aware and about which they are educated [42,43, 44], emphasizing that products and their features should be promoted to consumers as good products do not sell themselves. Reference [25], in his empirical work, concluded that the lack of awareness is a reason for non-adoption of innovative technology applications. Similarly, a study conducted by the Auckland University of Technology emphasized the awareness factor as "the most" important factor in mobile payments [26]. Another study found that the information provided on the banking websites helps to motivate adoption [54]. Hence, if

students are not adopting the contactless payment technology, it may be because they are not aware of its availability and added value. Furthermore, the absence of awareness eliminates consumers' PU and, of course, the PEOU. Thus, we hypothesize the following:

H1: Awareness (A) of contactless payments has a positive impact on the perceived ease of use (PEOU).

H2: Awareness (A) of contactless payments has a positive impact on the perceived usefulness (PU).

Defining trust is confusing due to the various definitions available in the literature. From a social psychology perspective, trust is defined as "the belief that the promise of another can be relied upon and that, in unforeseen circumstances, the other will act in a spirit of goodwill and in a benign fashion toward the trustor" [39]. Thus, trusting here means that users have faith and depend on the contactless payment technology even though they cannot control the technology or vendors. In several studies related to online technology use for banking or financial transactions, trust was found to be a significant factor for consumer adoption [39, 40]. Hence, we postulate the relationship of trust with the usefulness and ease of use to be positive:

H3: Trust (T) in contactless payments has a positive impact on the perceived ease of use (PEOU).

H4: Trust (T) in contactless payments has a positive impact on the perceived usefulness (PU).

Consumers express concerns regarding transaction security. They consider lack of security to be an inhibitor to the adoption of electronic banking solutions and to negatively affect both revenue and customer loyalty [46, 47, 48]. Security has also been identified as a key consumer concern in other Internet banking adoption studies (e.g., [49, 50]). In the context of consumer attitudes toward Internet banking systems, trust may be related to consumer judgment on security and privacy issues [51]. Additionally, the absence of privacy policy in electronic solutions forfeits the confidence of consumers [52], [53]. Moreover, in examining the security of contactless payment systems, consideration should be given to privacy threats and the different adversarial attacks that these systems must defend against. Reference [28] analyzed the underlying trust assumptions, security measures, and technologies that form the basis on which contactless payment cards and NFC-enabled mobile wallets exchange sensitive transaction data with contactless POS terminals. Some research suggests that the risk perceived among consumers of online shopping is one of the main factors that hinder its development [55]. Gender issues may also be relevant. Reference [56] studied Internet banking consumers and found that women regarded privacy protection and ethical standards more seriously than did men. Reference [30] used the TAM, as well as the perceived security model, comparing the factors that determine the acceptance by consumers of SMS and NFC mobile payment systems as examples of means of future payment [29]. The experimental results of [31] show that malicious apps can effectively spy on contactless payment transactions. We hypothesize the following:

H5: Privacy and security (PAS) of contactless payments have a positive impact on the perceived usefulness (PU).

The ease of use and PU of contactless payments will directly influence the intention to use based on the principles of the TAM [30]. Thus, we propose the following hypotheses:

H6: Perceived ease of use (PEOU) of contactless payments have a positive impact on the behavioral intention to use (BITU).

H7: Perceived usefulness (PU) of contactless payments has a positive impact on the behavioral intention to use (BITU).

Figure 2. summarizes the influences and effects of the factors mentioned in the hypotheses, where awareness (A) and trust (T) impact PU and PEOU, whereas PAS only impacts PU. PU and PEOU can then predict BITU.

4. METHODOLOGY

A. Sampling Process

According to a study, people who spend time in formal education and who are exposed to new technology are more likely to be early adopters [27]. Thus, an ideal target population for this research was determined: University of Bahrain students. The University of Bahrain has a total of 24,970 students. The required sample size for that population was calculated using an online sample size calculator. The calculated sample size was 153, which is considered to have a high confidence level (95%) and a confidence interval of 8.

B. Instruments and Data Collection

For data collection, a closed-ended questionnaire was developed. The questionnaire was divided into two sections. The first section covered demographic information, which gathered general data about the respondents to support the study aims through multiple choice questions. The second section included 23 questions with six factors based on the proposed TAM (see Figure 2. The answers were obtained using a Likert scale with a scale ranging from 1 to 5, where 1 represents "Highly Disagree" and 5 represents "Highly Agree." The questionnaire was distributed to the desired population using an electronic tool: Google Forms. A sample of 156 was obtained.

In the case of this study, the questionnaire measured the adoption and impacts of contactless payments on university students. It was important to ensure that the instrument was valid for this purpose and actually measured what was needed [32]. Thus, a pilot experiment was applied to a group of 10 random students, who were given a sample of the questionnaire to complete and discuss each question.

TABLE II. FACTOR ANALYSIS RESULTS USING SPSS

Factor	Item	Factor Analysis Score
Awareness (A)	A1	0.856
	A2	0.795
	A3	0.831
Privacy and Security (PAS)	PAS1	0.820
	PAS2	0.860
	PAS3	0.854
	PAS4	0.829
Trust (T)	T1	0.867
	T2	0.826
	T3	0.855
	T4	0.784
Perceived Ease of Use (PEOU)	PEOU1	0.770
	PEOU2	0.786
	PEOU3	0.777
	PEOU4	0.838
Perceived Usefulness (PU)	PU1	0.819
	PU2	0.747
	PU3	0.737
	PU4	0.823
Behavioral Intention to Use (BITU)	BITU1	0.826
	BITU2	0.886
	BITU3	0.897
	BITU4	0.804

The feedback from this pilot experiment was used to remove unnecessary questions, simplify the wording, and organize the questionnaire into sections. The participants in this pilot experiment were not included in the sample. Additionally, the questionnaire was examined by four experienced faculty members from the Information Systems department to ensure its face validity. Furthermore, a factor analysis was run using the Statistical Package for Social Science (SPSS) to check the construct validity. The factor analysis results were all greater than 0.5, suggesting that no items should be removed from the analysis and confirmed the six constructs (see TABLE II. The reliability of the instrument was also tested. The results obtained from the questionnaire used in this research should be replicable if it is redistributed in the same environment [32]. Thus, a Cronbach's alpha reliability test was run. The results indicated good levels of consistency (see TABLE III. ranging from 0.761 (acceptable) to 0.876 (good).

TABLE III. RELIABILITY RESULTS USING CRONBACH'S ALPHA

Factor	Number of Items	Cronbach's Alpha (α)
Awareness (A)	3	0.761
Privacy and Security (PAS)	4	0.860
Trust (T)	4	0.853
Perceived Ease of Use (PEOU)	4	0.801
Perceived Usefulness (PU)	4	0.778
Behavioral Intention to Use (BITU)	4	0.876
All Factors Combined (overall)	**23**	**0.946**

5. RESULTS AND DISCUSSION

The analysis of the results was divided into descriptive analysis, model factors analysis, and hypotheses testing.

A. Descriptive Analysis

A cross-tabulation test was used to examine the relationship between gender and income (pocket money), and the results showed that 60% of female students indicated that their monthly income was less than BD50, compared to only 47.3% of males. This indicates that males generally have more pocket money than females. The dominant age of respondents was between 18 and 25 years (94.3%). A cross-tabulation test between age and year of study showed that the remaining 5.7% were rare cases where respondents were either freshmen students who joined school early or senior students who were not following their curriculum plan or had faced some issues that slowed down their progress.

About 91% of the respondents were married. This is normal in our culture as most students prefer to delay marriage until they graduate and get a job. A cross-tabulation test indicated no significant relationship between marital status and age, year of study, or gender.

More than half of the respondents were senior students in their fourth year (53.2%). About 20% were third-year students, and 26.8% were freshman and sophomore students. A cross-tabulation test showed that the concentration of females in the fourth year was higher than that of males, where 57.5% of females were in their fourth year, and only 46.8% of males were in that same year.

Approximately 54% of the respondents reported that their monthly income was less than BD50. About 30% of the respondents had a monthly income between BD50 and BD149. Sixteen percent of respondents had both "BD150 to BD249" and "More than BD250," 8% for each. This shows that more than 80% of students had less than BD150 in pocket money. This is expected from students because their main source of money is probably from their parents.

B. Model Factors Analysis

This section presents analyses of the external factors that were proposed in this research model, as well as investigations into whether there were any patterns by running Mann-Whitney tests using SPSS. Mann-Whitney tests were used to compare each model factor with demographic variables to see if there was any pattern (e.g., are males more aware of contactless payment technologies than females?). Note that Mann-Whitney tests may exclude some items in the demographic variables to simplify the analysis (e.g., only include ages 18 to 21 and 22 to 25 and exclude the other ages).

The results indicate that the awareness of contactless payment technologies for male students was higher than that of females, with a significance value of $p < 0.05$. It was also shown that younger students (18-21years old) were more aware than senior students ($p < 0.05$). There was a significant relationship ($p < 0.05$) between PAS and age, where junior students (18-21 years) believed that contactless payments were more secure than those aged 22 to 25. There was no significant relationship between PAS and other demographic factors. Consistent with PAS, trust in the contactless payment technology was higher in junior students than in seniors. In addition, students with income between BD50 and BD149 trusted the technology more than those who had less than BD50 in income. The study also revealed no relationships between the usefulness and ease of use of the technology and the demographic factors. For the BITU, the results showed a significant relationship with the respondents' income, implying that students with income between BD50 and BD149 had higher intention to use contactless payments than those with income less than BD50.

C. Hypotheses Testing

TABLE IV. illustrates the results of the hypotheses testing. Three regression analyses were conducted, the first performed to test the relationships between Awareness (A), Trust (T), and PEOU. The results showed that Awareness ($\beta = 0.351$, $t = 5.820$) and Trust ($\beta = 0.511$, $t = 8.471$) had a positive impact on PEOU. The second analysis was performed to test the relationships between Awareness (A), Trust (T), PAS, and PU. The results showed that Awareness ($\beta = 0.177$, $t = 2.817$), Trust ($\beta = 0.355$, $t = 3.859$) and PAS ($\beta = 0.305$, $t = 3.198$) had a positive impact on PU. The third analysis was performed to test the relationships between PEOU, PU, and BITU. The results showed that PU ($\beta = 0.725$, $t = 9.895$) had a positive impact on BITU, while PEOU ($\beta = 0.110$, $t = 1.505$) showed no impact on BITU.

Only one hypothesis was rejected, which means that Awareness (A), Trust (T), PAS, and PU influence the intention to adopt contactless payment technologies. However, the rejected hypothesis indicated that the respondents' intention to adopt this technology was not affected, even if it was difficult.

The first regression analysis showed that 50% of the variance in PEOU was explained by Awareness and Trust. The second regression analysis showed that around 50% of the variance in PU was explained by Awareness, Trust, and PAS. In addition, the third regression analysis showed that 66% of the variance in BITU was explained by PU. Multiple cross-tabulation tests were also used to check the patterns of the respondents' demographic information (see TABLE V.).

TABLE IV. HYPOTHESES TESTING RESULTS (REGRESSION)

Hypothesis	β	t	Sig.	Status
H1	0.351	5.820	0.000	Accepted
H2	0.177	2.817	0.005	Accepted
H3	0.511	8.471	0.000	Accepted
H4	0.355	3.859	0.000	Accepted
H5	0.305	3.198	0.002	Accepted
H6	0.110	1.505	0.134	Rejected
H7	0.725	9.895	0.000	Accepted

TABLE V. EVALUATION OF VARIANCE

Regression Analysis	Factor	Adjusted R^2
1	Awareness (A) Trust (T)	0.497
2	Awareness (A) Trust (T) Privacy and Security (PAS)	0.497
3	Perceived Ease of Use (PEOU) Perceived Usefulness (PU)	0.656

6. CONCLUSION AND FUTURE WORK

The key finding from this study is that most respondents indicated that they intend to use contactless payment in the future. Trust, PAS, and awareness are key factors that affect users' intention to adopt contactless payment technologies, but ease of use was not considered a key factor. Furthermore, the intention to adopt contactless payments was predicted by the students' income, where students with high income had a higher probability of adopting this technology. However, the respondents (students) generally had low income. This fact may affect the intention to adopt contactless payments. The study also found an association between students' income and intention to deal with contactless payments.

There is an intent to expand the study to a wider population in Bahrain, such as applying the study to a larger sample. It is also imperative to further study the security of contactless payment technologies and propose improved solutions to reduce users' concerns about security, privacy, and trust. In terms of research methodology, utilizing different data collection methods will allow respondents to be more descriptive and give a better picture of their opinion, as well as increase the accuracy of the findings.

ACKNOWLEDGMENT

The authors wish to acknowledge the help provided by the students Isa Aldosseri and Khadija Altattan in the data collection and analysis of this research.

REFERENCES

[1] T. Kokkola, The payment system: Payments, securities and derivatives, and the role of the Eurosystem. European Central Bank, Germany (2010).[Online] Avilable: https://www.ecb.europa.eu/pub/pdf/other/paymentsystem201009en.pdf

[2] N. Purnell, "Chinese lead the way in mobile payment," *The Wall Street Journal*, 23 September 2017. Avilable: https://www.wsj.com. [Accessed: June 18, 2018]

[3] M. West, "A new way to pay the fare," *The Wall Street Journal*, 24 October 2017. [Online]. Avilable: https://www.wsj.com. [Accessed: June 18, 2018]

[4] J. Amiel, S. Godbert, "The future of contactless mobile payment: with or without secure element?" June 2015. [Online]. Available: http://www.nextendis.com/wp-content/uploads /2015/06/Future-contactless-payment-WP-by-Nextendis.pdf. [Accessed 16 February 2018].

[5] N. Phair, "The truth about contactless payments," *Center for Internet Safety*, March 2016. [Online]. Available: http://www.canberra.edu.au/cis/storage/Contactless%20payments.pdf. [Accessed 16 February 2018].

[6] C. Vinzant, "Contactless credit card technology now available in the USA," *Creditcards.com*, 16 July 2007. [Online]. Available: https://www.creditcards.com/credit-card-news/contactless-credit-card-technology-1273.php. [Accessed 16 February 2018].

[7] Ray, "10 Countries riding the contactless payments wave," *Gomedici*, 10 February 2015. [Online]. Available: https://gomedici.com/10-countries-riding-contactless-payments-wave/. [Accessed 17 February 2018].

[8] C. Chai, "Contactless 'tap-and-go' cards finally enter US market," *Creditcards.com*, 15 November 2017.[Online]. Available: https://www.creditcards.com/credit-card-news/contactless-tap-and-go-cards-us-market.php. [Accessed 17 February 2018].

[9] B. Lovejoy, "Comment: China shows the future of mobile payment as it hits more than 50% of GDP," *9TO5MAC*, 30 May 2017. [Online]. Available: https://9to5mac.com/2017/05/30/the-future-of-apple-pay-mobile-payment-china/. [Accessed 17 February 2018].

[10] K. Helms, "Most popular contactless smart cards in Japan adding Bitcoin hardware wallets," *Bitcoin.com*, 20 June 2017. [Online] Available: https://news.bitcoin.com/contactless- smart-card-system-japan-bitcoin-hardware-wallets/. [Accessed 17 February 2018].

[11] A. Oxford, "FNB launches contactless payments from your phone," *Hypertext*, 5 October 2016. [Online] Available: https://www.htxt.co.za/2016/10/05/fnb-launches-contactless-payments-from-your-phone/. [Accessed 17 February 2018].

[12] M. Vejacka. Consumer acceptance of contactless payments in Slovakia. *Journal of applied economic science*. 35(5)2015. Available from: https://www.researchgate.net/publication/286843735_Consumer_acceptance_of_contactless_payments_in_Slovakia [accessed Apr 20 2019].

[13] H. Griffiths, "New Zealand: Consumers move away from cash as digital and contactless payments rise," *RFI Group*, 2017 [Online]. Available: https://www.rfigroup.com/rfi-group /news/new-zealand-consumers-move-away-cash-digital-and-contactless-payments-rise. [Accessed 17 February 2018].

[14] E. Ahmed, (2016). "The rising trend of cashless payments," *Gulf News*, 17 July 2016. [Online]. Available: http://gulfnews.com/business/sectors/banking/the-rising-trend-of-cashless-payments-1.1863595. [Accessed 26 January 2018].

[15] ChinaGoAbroad.com, "The mobile wallet rush: GCC banks paying great attention to digital wallets," *Islamic Finance news*, 2017. [Online]. Available: http://www.chinagoabroad.com/en/article/the-mobile-wallet-rush-gcc-banks-paying-great-attention-to-digital-wallets [Accessed 26 January 2018].

[16] TradeArabia.com, "Batelco, AFS launch new mobile payment solution in Bahrain," *Trade Arabia Business News Information*, 10 January 2018. [Online]. Available: http://tradearabia.com/news/BANK_335218.html [Accessed 26 January 2018]

[17] R. Jones, "Once it was touch and go, now contactless is a new-wave revolution," *The Guardians*, 10 September 2016. [Online]. Available: https://www.theguardian.com/money/2016/sep/10/contactless-cards-wave-pay-oyster-london-use [Accessed 29 January 2018].

[18] R. Green, "The UK loves contactless payments," *Business Insiders*, 6 September 2017. [Online]. Available: http://uk.businessinsider.com/the-uk-loves-contactless-payments-2017-9 [Accessed 26 January 2018].

[19] B. James, "How has the adoption of contactless payment affected UK students' Spending Habits?" Master dissertation, Cardiff Metropolitan University, 2017.

[20] L. Hooker, "Will paying with contactless cards make us less healthy?" *BBC News*, 23 May 2016. [Online]. Available: https://www.bbc.com/news/business-36358030 [Accessed 26 January 2018].

[21] J. Titcomb, "Mobile payments struggle to make impact on contactless card use," *The Telegraph*. 14 April 2017. [Online]. Available: https://www.telegraph.co.uk/technology/2017/04/14/mobile-payments-struggle-make-impact-contactless-card-use/ [Accessed 26 January 2018].

[22] E. Grobler, 'Contactless payments – The pros and cons of tap and go," *Finder*, November 2017. [Online]. Available: https://www.finder.com/contactless-payment [Accessed 9 February 2018].

[23] M. Chuttur, "Overview of the technology acceptance model: origins, developments and future directions," *Sprouts*, vol. 9, no. 37, 2009. [Online]. Avilable: http://aisel.aisnet.org/sprouts_all/290. [accessed 15 June 2018].

[24] V. Venkatesh and F. D. Davis, (1996). "A model of the antecedents of perceived ease of use: development and test," *Decision Sciences*, vol. 27, no. 3, pp. 451-481, 1996.

[25] M. Sathye, "Adoption of internet banking by Australian consumer: an empirical investigation," *International Journal of Bank Marketing*, vol. 17, no. 7, pp. 324-334, 1999.

[26] B. Wang, "Investigating mobile payment technologies as a replacement for cash/EFTPOS transactions," Master of Computer and Information Sciences (MCIS). Auckland University of Technology, Auckland, New Zealand, 2012.

[27] N. Hosein, "Internet banking: An empirical study of adoption rates among midwest community banks," *Journal of Business & Economics Research*, vol. 7, no. 11, pp. 51-72, 2009.

[28] F. Davis, "A technology acceptance model for empirically testing new end-user information systems: theory and results," Ph.D. In Management. Massachusetts Institute Of Technology, Cambridge, Massachusetts, United States, 1985.

[29] Xinyan, G. Wei, and L. Tingjie, "Study on consumer demands and merchant participation motives of mobile payment services in China," in *Proc. of the 2nd International Conference on Interaction Sciences: Information Technology, Culture and Human 2009*, 24-26 November 2009, Seoul, Korea, pp. 1447-1451.

[30] W. Alnaser, "Fast facts," 2017.[Online]. Available: http://www.uob.edu.bh/en/images /About_UOB/fast_facts_25-1-2017_En.pdf [Accessed 26 March 2018].

[31] University of Bahrain, "IS program statistics," 2018. [Online]. Available: http://www.uob.edu.bh/en/index.php/colleges/college of-information-technology/66-it/1190-program-statistics-is [Accessed 26 March 2018].

[32] O. A. Bolarinwa "Principles and methods of validity and reliability testing of questionnaires used in social and health science researches," *Niger Postgrad Med Journal*, vol. 22, pp. 195-201, 2015.

[33] M. Polasik, T. Wisniewski, G. Lightfoot. Modelling customers' intentions to use contactless cards. *International Journal of Banking Accounting and Finance*. 2012. 4(3):203-231. DOI: 10.1504/IJBAAF.2012.051590

[34] N. Akinyokun, V. Teaque. Security and Privacy Implications of NFC-enabled Contactless Payment Systems. *Proceedings of the 12th International Conference on Availability, Reliability and Security.2017*

[35] F. Cabanillas, I. De Luna, F. Rios. Intention to use new mobile payment systems: a comparative analysis of SMS and NFC payments**.** *Journal of Economic Research-Ekonomska Istrazivanja.* 2017. 30(1). https://doi.org/10.1080/1331677X.2017.1305784

[36] M. Mehrnezhad, M. Ali, F. Hao, A. Moorsel. NFC Payment Spy: A Privacy Attack on Contactless Payments. *International Conference on Research in Security Standardisation*. 2016. DOI: 10.1007/978-3-319-49100-4_4

[37] J. Wituschek. "Apple Card: Everything you need to know!" 2019. [Online]. Available: https://www.imore.com/apple-goldman-sachs-credit-card [Accessed 26 May 2019].

[38] F. Davis, R. Bagozzi and P. Warshaw. User acceptance of computer technology: A comparison of two theoretical models. *Management Science*. 1989. 35(8): pp. 982-1003.

[39] B. Suh, I. Han. Effect of trust on customer acceptance of Internet banking. *Electronic Commerce Research and Applications*. 2002. 1: 247–263.

[40] N. Rexha, R. Kingshott, A. Aw, (2003) The impact of the relational plan on adoption of electronic banking. *Journal of Services Marketing*. 2003. 17(1): pp.53-67.

[41] E. Rogers and F. Shoemaker. Conintunication of innovations: a cross-cultural approach. *New York Free Press*. 1971.pp. 476.

[42] Wallis Report. The financial system inquiry. Final Report. 1997. AGPS, Canberra.

[43] J. Howard and W. Moore. Changes in consumer behaviour over the product life cycle'' in Tushman and Moore (Eds), *Readings in the Management of Innovation*. 1982. Pitman, p. 128.

[44] R. Cooper. Examining some myths about new product winners. in Katz, R. (Ed.), *The Human Side of Managing Technological Innovation*. 1997. Oxford. pp. 550-60.

[45] N. Jahangir and N. Begum. The role of perceived usefulness, perceived ease of use, security and privacy, and customer attitude to engender customer adaptation in the context of electronic banking. *African Journal of Business Management*. 2008. 2 (1): pp. 032-040.

[46] W. Chung and J. Paynter. An evaluation of internet banking in New Zealand. *Proceedings of the 35th Hawaii International Conference on System Sciences* 2002, 10 January,2002, Big Island, HI, USA.

[47] K. Williams. Are you ready for I-banking. *Management Accounting*. 2000. 81(10): 23-82.

[48] C. Hamlet. Community banks go online. *ABA Banking Journal*. 2000. 92(3): 61-64.

[49] N. Black, A. Lockett, H. Winklhofer, C. Ennew. The adoption of Internet financial services: a qualitative study. *International Journal of Retail & Distribution Management.* 2001. 29(8): 390-398.

[50] N. Siu and J. Mou. Measuring Service Quality in Internet Banking: the Case of Hong Kong. *Journal of International Consumer Marketing*. 2005. 17(4): pp. 97-114.

[51] Y-S. Wang, Y-M. Wang, H. Lin and T. Tang, T-I. Determinants of user acceptance of Internet banking: an empirical study. *International Journal of Service Industry Management.* 2003. 14(5): pp. 501-519.

[52] W. Chung and J. Paynter. Privacy Issues on the Internet. *Proceedings of the 35th Hawaii International Conference on System Sciences* 2002, 10 January,2002, Big Island, HI, USA.

[53] B. O'Connell. The Internet – Redefining Banking. *The Australian Banker*. 1998. June. pp110-111.

[54] K. Waite and T. Harrison. Consumer expectations of online information provided by bank websites. *Journal of Financial Services Marketing*. 2002. 6(4): pp. 309-22.

[55] D. Gefen, E. Karahanna and D. Straub. Inexperience and experience with online stores: The importance of TAM and trust. *IEEE Transactions on Engineering Management*. 2003. 50: pp.307–321.

[56] G. Shergill and B. Li. Internet banking - An empirical investigation of customers' behaviour for online banking in New Zealand. *Journal of E-business*. 2005. 5(1): pp.1-16.

Maan Aljawder is an Assistant Professor of Information Systems received his Ph.D. in Information Systems from the University of Sydney in Australia in 2015. He is a certified Enterprise IT process capability assessor (COBIT 5 Assessor). His research interest is in Smart Cities, IS Project Management, IT Strategy, Enterprise Systems, and Business Intelligence.

Amerah Abdulrazzaq is an assistant professor in the Department of Information systems. She received her PhD, Information Studies, 1997. Her research interests include: Managing and Organizing Information, Information and Retrieval, Auditing and Controlling in IT Environment, and Data and Information Management.